PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Respiratory Valves

I, Edouard Paul Victor Raoul Godel, of French nationality, of 16, rue du Champ-Renie, Saint-Maur, Seine, France, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a new automatic valve particularly intended to be utilized for urgently reviving or anaesthetizing patients.

The particularly simple embodiment and easy taking apart of the members forming this automatic valve make it possible to obtain a light and strong unit very easy to use and also easy to clean, seeing that all parts can be taken apart with the greatest ease.

Moreover, the automatic valve of the invention is made so that all the elements pertinent to the ensuring of its proper working are united so that they may be controlled by one hand, all these elements being, moreover, always under the watchful eye of the assistant or other operator using them.

In accordance with the invention, an automatic valve assembly for the forced insuflation and spontaneous exhalation of gas or vapour by a patient, more particularly for anaesthesia and reviving, comprises a hollow body provided with several connecting bushings for positioning multiple accessories, said connecting bushings being provided with at least one non-return valve enabling gas to enter from the exterior to the interior of the body, a blower mouthpiece for increasing the pressure inside the body, a valve limiting the pressure inside the body, and an automatic diaphragm valve assembly interposed between the inside of the body and a respiratory mouthpiece for connecting to the patient, this automatic diaphragm valve assembly comprising a distortable flexible diaphragm associated with a valve, the flexible diaphragm being normally maintained by the valve in a position in which the mouthpiece is in communication with an exhaust circuit for air breathed out by the patient, the flexible diaphragm being brought by the pressure set up in the valve body to a position in which it closes the exhaust circuit and enables the valve to be opened, so that the gas under pressure in the valve body is insufflated to the patient through the mouthpiece.

Various other characteristics of the invention will moreover be revealed in the detailed description which follows.

An embodiment of the invention is shown, by way of non-restrictive example, in the attached drawing, in which:—

Fig. 1 is a sectional elevation of an automatic valve assembly according to the invention;

Fig. 2 is a sectional view along the line II—II of Figure 1;

Fig. 3 is a section showing a detail of a group of members shown in Figure 1;

Fig. 4 is a section of an alternative embodiment of one of the members of the valve assembly shown in Figure 1.

The automatic valve assembly for forced insufflation to and spontaneous breathing out of gas or vapour from a patient comprises a body 1 preferably made of moulded material, such as plastics, and this body comprises, on one side, a tapped bushing 2 into which is screwed or fitted a socket 3 holding an automatic valve 4.

The inner wall of the socket 3 is advantageously shaped so as to enable it to be connected up to a mouthpiece 5 able to connect the valve body to a cartridge for filtering toxic gases, or a blower, or an anaesthetizing gas distributor members shown diagrammatically in chain dotted lines at 6.

The valve body 1 forms, preferably in

opposition with regard to the bushing 2, a nozzle 7 intended to be connected by piping 8 to hand bellows, or any other device for conveying air under a certain pressure, this device being able to be made simply of a mouthpiece enabling mouth-to-mouth operations to be performed.

In this latter case, to enable the mouth-to-mouth operation to efficacious, it is necessary that the effective volume contained in the piping should be about 350 cm^3, seeing that the volume of the upper air passages of the operator is about 150 cm^3, which enables a variable insufflation volume of 500 cm^3 of air to be obtained practically new in oxygen, that the operator by exhaling, causes to penetrate into the patient's lungs.

At its top part, the valve body 1 forms a bushing 9 into which a socket 10 is screwed or fitted forming the body of a valve 11, calibrated by an adjustable spring 12, in order to limit the insufflation pressure to a value selected beforehand. The valve 11 is guided by its stem whose end extends slightly beyond the guide 13, which enables it to be closed by a finger for temporarily effecting considerable overpressure when it is necessary, for example, to overcome a bronchospasm.

The body 1 has a base 14 approximately at right angles to the bushing 2 and the mouthpiece 7, into which base there is fixed a non-return valve 15, which is of the ball (16) type and is mounted so as to enable a supplementary gas, such as oxygen to be introduced into the respiratory circuit as close as possible to the patient.

A second base 17 is provided opposite the base 14 and the apertures made in this base has the same diameter as that of the base 14 and is normally closed by a plug 18 that can be easily removed, making it possible to connect the valve body with a pipe for taking a sample of the inhaled mixture, more particularly for making an analysis of this mixture, or for putting a pressure-gauge in position showing the insufflation pressure, or else for conveying another gas or vapour.

The underneath of the valve body has a large diameter bushing 19 in which a valve is placed, indicated generally by 20. This automatic valve comprises, as shown in detail in Figure 3, a base 21 on which a hollow projection is formed, 22 denoting the bottom and 23 denoting apertures made in the periphery of this projection.

The base 21 is advantageously made of moulded material such as plastics, preferably a superpolyamide, so that it can be sterilised, as well as the rest of the valve, and supports a diaphragm 24 which is made of a very flexible material, such as rubber.

The diaphragm 24 is normally pressed against the bottom 22 of the hollow projection and has, at its central part, an aperture 25 of as large a diameter as possible but nevertheless smaller than that of the bottom 22. The bottom 22 of the hollow projection is pierced and supports a guide 26 in which stem 27 of a valve 28 is engaged, normally maintained pressed against the underneath of the diaphragm 24, and consequently against the bottom 22 of the hollow projection by a very weak spring 29 which bears against a stop 30, advantageously formed by a nut screwed on to the stem 27 of the valve.

The assembly described above and shown in Figure 3 is housed inside the large diameter bushing 19 and held against an annular shoulder-piece 31, formed on the body 1, by means of a ring 32 hvaing a flange 33 housed in a groove of said bushing 19 and held in the latter by the peripheral edge of a mouthpiece 34 connected to the body 1 by a detachable collar 35.

In its lateral wall, the mouthpiece 34 has apertures 36 and a small collar 37 internally whose upper peripheral edge is intended to act as a housing for the diaphragm 24 during certain of the working stages. The mouthpiece 34 described above and provided with apertures 36, is intended to allow the patient to breathe out directly into the atmosphere. Actually, this mouthpiece is normally connected to the patient's respiratory passages, for example, by a sub-labial mouthpiece 38 shown in chain dotted lines, i.e. a mouthpiece of the kind which is suitable to be inserted between the lips and the teeth. However, any other suitable mouthpiece can be used.

When it is desirable that the patient should not breathe out directly into the atmosphere, the mouthpiece 34 is made as shown in Figure 4, where it is denoted by the reference 34*a*. In this case, this mouthpiece does not have apertures 36 but a connection 39 making breathing out possible into any kind of circuit, enabling analyses to be made, for example, or else enabling operation in a closed circuit, or spirometric measurements to be taken.

As is well known, respiration consists of two principal movements, namely breathing in and breathing out, separated by a short test time.

By considering that the automatic valve described above is intended to revive a patient, it is necessary, from the start of reviving operations in insufflate air or another gas, either by bellows connected to the nozzle 7, or by the "mouth-to-mouth" precedure, so that said automatic valve, described above, forms a continuous circuit between the patient and the source of insuffled air.

To obtain this result, the air coming from the direction of arrow f$_1$ passes through the apertures 23 of the hollow projection formed inside the diaphragm 24 and consequently this air reaches the interior of this diaphragm whose aperture 25 is closed by the valve 28 retained by the spring 29.

As soon as the pressure is sufficient inside the diaphragm, the latter is moved and presses against the peripheral edge of the small collar 37.

This results in an air-tight contact in relation to the external medium, and from that moment, the diaphragm not being able to be distorted any further, it is the valve 28 which is moved against the action of the spring 29 to enable the insufflation air whose dynamic force and pressure are sufficient easily to overcome the force of said spring 27 to pass through the aperture 25 of the diaphragm.

If there is no delivery, which happens, for example, when the insufflation pressure is maintained without delivery, or when the pressure is equal on both faces of the valve 28, the latter returns to press against the diaphragm without the latter being raised again.

It will be noticed that the more the air pressure is increased, the more strongly will the diaphragm be pressed against the edge of the small collar 37, and this in a pressure ratio that depends upon the ratio between the diameter of the valve and the diameter of the insufflation tube formed by the mouthpiece 34. The greater this ratio, the more sensitive will be the automatic valve forming the assembly in Figure 3.

The air passing, as explained above into the valve of the invention, like into a continuous tube, thus insufflates the patient so long as a positive pressure is imparted to this air. On the other hand, as soon as a negative pressure of fresh air intake is effected by the bellows connected up to the nozzle 7 with a view to the following insufflation, this negative pressure will have the effect of more strongly pressing the valve 28 on the diaphragm 24 which will return to pressing against the bottom 22 of the hollow projection, the diaphragm then forming a non-return valve. The bellows connected to the connection 7 can thus only draw in fresh air through the inlet valve 4, and consequently, no reinhalation of exhaled air is possible.

Under the action of a depression, as soon as the diaphragm 24 returns to press against the bottom 22, it frees the space provided between it and the edge of the small collar 37, which enables, through this space, the spontaneous breathing out of the patient, without any effort.

The breathed air comes out at this moment, either through the apertures 36, or through the connection 39.

As already explained in the description, the valve 11 is intended to prevent accidental overpressures in the patient's respiratory passages, while nevertheless permitting, in certain cases, the developing of sufficient pressures inside the automatic valve.

WHAT I CLAIM IS:—

1. An automatic valve assembly for the forced insufflation and spontaneous exhalation of gas or vapour by a patient, which comprises a hollow body provided with several connecting bushings for positioning multiple accessories, said connecting bushings being provided with at least one non-return valve enabling gas to enter from the exterior to the interior of the body, a blower mouthpiece for increasing the pressure inside the body, a valve limiting the pressure inside the body and a diagphragm valve assembly interposed between the inside of the body and respiratory mouthpiece for connection to the patient, this diaphragm valve assembly comprising a distortable flexible diaphragm associated with the valve, the flexible diaphragm being normally montained by the valve in a position in which the mouthpiece is in communication with an exhaust circuit for air breathed out by the patient, the flexible diaphragm being brought by the pressure set up inside the valve body to a position in which it closes the exhaust circuit and enables the valve to be opened so that gas under pressure in the valve body is insufflated to the patient through the said mouthpiece.

2. An automatic valve assembly according to Claim 1, in which the diaphragm valve assembly comprises a bellows-shape diaphragm whose periphery is fixed to a flat support having a hollow apertured projection open to the body, a valve passing through and supported by the hollow projection and adapted to open or close an aperture formed in the diaphragm, and a spring interposed between the hollow projection and a stop on the valve, the arrangement being such that if the pressure in the body does not exceed the pressure on the side of the diaphragm remote from the body the valve closes the aperture in the diaphragm under the influence of the spring but if the pressure rises in the body the diaphragm expands till it closes the exhaust circuit and the pressure subsequently opens the valve, thus providing communication between the body and the mouthpiece.

3. An automatic valve assembly according to Claim 2, in which the spring tension of the valve associated with the diaphragm is adjustable.

4. An automatic valve assembly according to any one of Claims 1 to 3, in which the respiratory mouthpiece is provided with an annular duct situated around a small collar forming a seating against which the diaphragm expands before the valve opens.

5. An automatic valve assembly according to Claim 4, in which a single aperture is formed in the annular duct, the aperture

being fitted with a connector intended to connect the duct to a piping leading to accessories.

6. An automatic valve assembly according to Claim 4, in which two or more apertures are formed in the annular duct, the apertures being open to the atmosphere.

7. An automatic valve assembly according to any one of Claims 4, 5 and 6, in which the peripheries of the annular duct and of the bushings in which the diaphragm valve assembly fits are flanged and are held together by a detachable collar.

8. An automatic valve assembly according to Claim 7, in which the diaphragm valve assembly is held in place by a ring having a peripheral flange gripped between the flanges of the duct and the bushing.

9. An automatic valve assembly according to any one of Claims 1 to 8, in which the valve limiting the pressure that can be set up inside the valve body is associated with an adjustable spring and has a stem projecting outside the valve body which enables it to be closed manually when a particularly high pressure is required inside the valve body.

10. An automatic valve assembly according to any one of Claims 1 to 9, in which the various parts are made of moulded material and form a solid assembly utilizable without modification for operating "mouth-to-mouth" treatment or by means of a hand or mechanically operated bellows.

11. An automatic valve assembly according to Claim 10, in which the various parts are made of plastics material.

12. An automatic valve assembly according to Claim 11, in which the plastics material is a superpolyamide.

13. An automatic valve assembly according to any one of Claims 1 to 12, in which the valve body comprises in addition to the large diameter bushing accommodating the respiratory connection to the patient, at least four bushings radially disposed with respect to a common junction, one at least of these bushings supporting a connecting element provided with a non-return valve capable of putting the interior of the valve body into communication with a gaseous source.

14. An automatic valve assembly according to any one of Claims 1 to 13, in which the respiratory mouthpiece is fitted with a sublabial mouthpiece.

15. An automatic valve assembly for the forced insufflation and spontaneous exhalation of gas or vapour by a patient, substantially as hereinbefore described with reference to and illustrated in the accompanying drawings.

For the Applicant,
D. YOUNG & CO.,
Chartered Patent Agents,
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910065 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig.1.

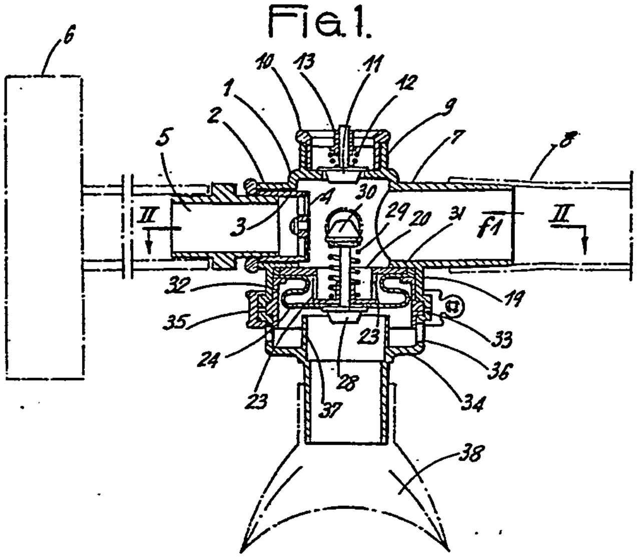

Fig.3.

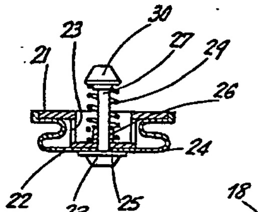

Fig.4.

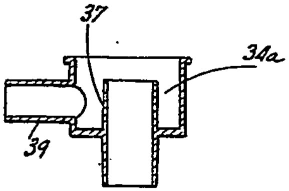

Fig.2.